REMARKS

Claims 1 and 7 have been amended to more clearly point out the subject matter that Applicants regard as their invention. As such, claims 1-10 are presently pending.

The Examiner rejected claims 1-10 under 35 U.S.C. §112, second paragraph as being indefinite. Applicants submit that in light of the amendments to the claims, this ground of rejection is hereby rendered moot. This being said, it should be noted that the original language did not present "a relative term" which would render the claim indefinite. A polymer membrane for a fuel cell is a proton exchange type of electrolytic device in that it transports hydrogen ions or protons. A common type of such a membrane utilizes a PTFE backbone with side chains that end in sulphonic acid groups. Negatively charged SO_3^- species are permanently bonded to the side chain. However, when the polymer becomes hydrated by adsorbing water, the positively charged hydrogen ions become mobile species by bonding to water molecules and hopping from SO_3^- site to SO_3^- site through the material. If such membrane is allowed to dry out, it will no longer be activated and thus be incapable of hydrogen ion transport. Hence, it is well known that these type of membranes have to be kept hydrated to be practically utilized and the same is achieved by operating the membrane on a scheduled basis to consume hydrogen to remain hydrated while not in use in powering an electrical load. The amount of hydrogen to be consumed in such scheduled maintenance would simply be a known matter of calculation to those skilled in the art. Put another way, such membranes could not be utilized in remote locations on an intermittent basis without one being able to understand the amount of hydrogen to be consumed for maintenance purposes as opposed to the requisite amount of hydrogen that would be required to produce a rated power output.

The Examiner rejected claims 1-5 and 7-10 under 35 U.S.C. §102(e) as being anticipated by Shabana et al. Applicants submit aside from the fact that Shabana et al. consumes hydrogen and utilizes a polymer membrane, this reference discloses none of the other features that are recited in claim 1 and claim 7, the independent claims of the instant case.

Turning first to claim 1, a hydrogen storage system is provided for supplying hydrogen to a fuel cell employing a polymer membrane. The fuel cell consumes part of the hydrogen to power a load in accordance with the

predetermined electrical power requirement and a further part of the hydrogen to operate on a scheduled basis when not powering the load to maintain the polymer membrane in a hydrated condition. In such system the main hydrogen storage site exists to contain the part of the hydrogen that the fuel cell would consume to generate the predetermined electrical power requirement and an auxiliary storage site to contain the further part of the hydrogen that would allow the fuel cell to operate on the scheduled basis for hydration purposes. A manifold is connected to the main hydrogen storage site and the auxiliary hydrogen storage site and is provided with a flow control network to allow the fuel cell to withdraw the hydrogen from the auxiliary hydrogen storage site to maintain the polymer membrane in the hydrated condition without utilizing the hydrogen from the main hydrogen storage site. Further, the auxiliary hydrogen storage site can be renewed independently of the main hydrogen storage site. The advantage of this is that the entire hydrogen storage site does not have to be recharged periodically for maintenance purposes. Rather, the auxiliary site is simply renewed.

Shabana et al. discloses a hydrogen processing unit 30 which is configured to selectively receive hydrogen gas either a compressed gas source, a liquid hydrogen source or a solid hydrogen source, but not all at once. Rather, hydrogen processing unit 30 is configured to be flexible to utilize hydrogen from any one of such sources. As indicated in paragraph 24 thereof, "Therefore, for example, the hydrogen processing unit 30 may be installed as part of a fuel system 10 in a vehicle. As developments occur in the design, manufacture and use of different forms of hydrogen storage media, the originally installed hydrogen storage media may be removed from the vehicle and replaced by a different type of hydrogen storage media which includes hydrogen stored in a different state…" Therefore, it is apparent that Shabana et al. envisions that compressed gas contained in containers 40 and 42 would be used. However if solid hydrides became practical, the same would replace the compressed gas as the source of hydrogen. In this regard, in the description of Figure 1, a common manifold 44 carries hydrogen gas from storage tanks 40 and 42 to the hydrogen processing unit 30, wherein a hydrogen pressure regulator 36, such as a throttle valve, drops the pressure to a desired stack pressure such as 10 bars to provide 1.3 to 3 bars at the hydrogen cell stacks. Heat exchanger 32 in hydrogen

processing unit 30 would heat the gas to a desired stacked temperature. Note here that the compressed hydrogen gas would flow from both containers at once until both were depleted. The same is true with respect to Figure 2 in which a fuel cell system 110 is shown in which three compressed gas hydrogen storage tanks 112, 114 and 116 are connected to a common manifold 118 for delivery to a hydrogen processing unit 130. Hydrogen would be drawn simultaneously from all three storage tanks and not just one of the storage tanks for maintenance purposes as recited in claim 1. There are no check valves and the like such that one of the tanks could be renewed independently from the other of the tanks and hence, none would constitute an auxiliary hydrogen storage site. Also, it is to be noted that the manifold 118 has no flow control network to allow the fuel cell to draw the hydrogen from just one of the tanks. All three tanks feed the manifold 118 at once. Consequently, Shabana et al. does not anticipate claim 1.

Claim 7 is likewise not anticipated because again Shabana et al. is configured to supply hydrogen simultaneously from all sites and hence, it does not have a provision for supplying the part of the hydrogen fuel cell that is used to generate electricity to power the load from a main hydrogen storage site and supplying the further part of the hydrogen to the fuel cell on a scheduled basis from an auxiliary hydrogen storage site. Furthermore, it does not disclose nor is it at all operable to provide for periodically renewing an auxiliary hydrogen storage site so that it remains charged with the further part of the hydrogen that is used for maintenance purposes.

Applicants further submit that since claims 1 and 7 are in allowable form, claims 2-6 and 8-10 should be allowable on the same basis. However, a few comments are in order with respect to the rejection of the dependent claims.

Claim 2 calls for the flow control network to be provided with pressure regulators configured such that the hydrogen from the auxiliary hydrogen storage site is delivered to the outlet of the network before the hydrogen stored in the main hydrogen storage site and check valves are also provided to prevent the flow of hydrogen between the main and auxiliary hydrogen storage site. In Shabana et al., the pressure regulator 36 mentioned above is fed by all tanks simultaneously to maintain a pressure suitable for the fuel cell stack. Further, there is no provision for check valves in the flow control network so that the flow

of hydrogen is prevented between tanks. As indicated above, all tanks simultaneously feed the fuel cell stacks.

There is no provision in Shabana et al. for multiple pressure regulators as recited in claims 4, 5 and 6 so that hydrogen is drawn from a single gas cylinder serving as the auxiliary site and then from a cylinder or cylinders serving as the main hydrogen storage site.

The Examiner next rejected claims 1-2 and 7-8 as being anticipated under 35 U.S.C. §102(b) by JP'470 publication. Applicants submit that the Examiner's statements with respect to this reference are mere conjecture in that the abstract referred to by the Examiner does not relate to Fig. 6, but rather Fig. 1. Applicants have submitted a copy of this abstract herewith. This being said, any interpretation of Fig. 6 based on the abstract of this reference would be entirely at variance with the Examiner's comments contained in the rejection.

Applicants submit that Fig. 6, properly interpreted from the abstract, discloses a system for storing hydrogen to be used in generating electrical power at the time of a power shortage. Surplus power from power regulation units 3a and 3b is used to electrolyze water fed out of a water storage tanks 15a and 15b by pumps 16a and 16b, made into steam and then electrolyzed within units 4a and 4b to generate hydrogen to be stored within hydrogen storage tanks 24a and 24b. It is to be noted that elements 25a and 25b are given the same symbol as pumps 16 in Fig. 1 and therefore, it is unlikely that they are pressure regulators or indicators as alleged by the Examiner. In any case, at the time of a power shortage, the hydrogen is supplied back to units 4a and 4b, which are oxygen hydrogen electro-chemical reactors (mis-numbered as 14 with respect to Fig. 1 in the abstract) to generate power.

It would appear that there exists a connection between the hydrogen storage tanks 24a and 24b but no connection with both of the tanks to feed either unit 4a or 4b. As such, it would appear that while possibly, the hydrogen storage tanks 24a and 24b can feed each other, hydrogen storage tank 24a solely feeds unit 4a and hydrogen storage tank 24b solely feeds unit 4b.

Consequently, there is no manifold connected to both of two hydrogen storage sites 24a and 24b that would allow hydrogen to be fed from, for example either hydrogen storage site 24a or site 24b to unit 4a through an outlet thereof. There is no need for a manifold that would allow one storage site to be renewed

independently of the other in that without any manifold, the sites 24a and 24b are renewed independently of one another. Nor is there a flow control network that would allow either of the units 4a or 4b to draw hydrogen from one site for maintenance purposes and the other site to generate electricity in that when electricity is not being generated, water is being electrolyzed to generate the hydrogen. Hence, JP'470 does not anticipate claims 1 and 2 nor render the same obvious. Claims 7-8 are likewise not anticipated in that there is no disclosure nor any mechanism provided in this reference to supply hydrogen from both of sites 24a and 24b to either unit 4a or 4b for any purpose nor is there any need to periodically renew one of the sites so that it remains charged to allow either unit 4a or 4b to operate on a scheduled basis to remain hydrated. In this regard, when not generating power, units 4a and 4b are exposed to water for hydrolysis and hence, remain hydrated.

The prior art cited against the case but not applied against the claims has been reviewed but is not believed to affect the patentability of the presently pending claims.

Applicants are aware that this response is being made within the first month. Applicants have therefore included a petition to extend the time to respond within the first month, together with directions to charge deposit account no. 16-2440 in the amount of 120.00.

In view of the amendments to the claims and the remarks set forth above, reconsideration of the rejection and the allowance of all presently pending claims is requested. Since the claims are in condition for allowance, prompt and favorable action is hereby requested.

Respectfully submitted,

David M. Rosenblum
Attorney for Applicants
Reg. No. 29,341

Danbury, Connecticut 06810
(203) 837-2116
December 28, 2005
D-21357

Enclosure: Patent Abstracts of Japan, JP 4115470

POWER STORAGE GENERATOR

Patent number: JP4115470
Publication date: 1992-04-16
Inventor: MAEKAWA TSUTOMU others: 03
Applicant: TOKYO ELECTRIC POWER CO INC:THE others: 01
Classification:
- international: H01M8/18; H02J15/00
- european:
Application number: JP19900234543 19900906
Priority number(s):

Report a data error here

Abstract of **JP4115470**

PURPOSE:To efficiently perform power preservation by electrolyzing steam with the use of surplus power to produce and store hydrogen and at the time of power shortage supplying the hydrogen to a fuel cell for power generation.
CONSTITUTION:The surplus power of a power source line 2 from a power regulation unit 3 is converted into a direct current and applied to a hydrogen electrode 8 and an oxygen electrode 9. Nextly, water is fed out from a water storage tank 15 by a pump 16 and made into steam having a temperature of not less than approximately 800 deg.C by heat exchangers 17, 18, 20, and the steam is fed to a hydrogen-electrode-side manifold 10 and electrolyzed there and then stored in a hydrogen storage tank 24. And then at the time of power shortage the hydrogen is supplied to the hydrogen-electrode-side manifold 10 from the hydrogen storage tank 24 and oxygen is supplied to an oxygen-electrode-side manifold 11 and power generation is performed in an oxygen hydrogen electro- chemical reactor 14, whereby since the steam is electrolyzed by the surplus power and the hydrogen is produced and stored and at the time of power shortage the power generation is performed by electro- chemical reaction of hydrogen, power storage may be efficiently performed.